# Overview of Hypersonic Inflatable Aerodynamic Decelerator Large Article Ground Test Campaign

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Hypersonic inflatable aerodynamic decelerators (HIADs) offer considerable advantages over rigid aeroshell technology for human and robotic missions requiring atmospheric entry.[ref] Most noteworthy are the considerable system mass and volume fraction savings over conventional rigid aeroshells. In addition, inflatable aeroshells Currently, HIADs are being considered for returning payloads from low earth orbit and landing heavy payloads on the surface of Mars. The Inflatable Re-entry Vehicle Experiment (IRVE) has successfully demonstrated various aspects of HIAD technologies including exo-atmospheric inflation, inflatable structure performance, thermal protection system performance, aerodynamic stability and structural integrity under aerodynamic pressure.[ref] IRVE-II, flown in 2009, a 3.0 meter diameter, 60 degree half-angle sphere cone enabled the validation of a number of design tools and approaches for inflatable decelerator technology.[ref] Scaling HIADs to the diameters relevant to the aforementioned entry missions (>10 meter diameter) presents unique challenges for validating the performance and design of such systems. There are many unquantified risks to the utilization of such large structures, such as control authority, fluid structure interactions, dynamic stability and system complexity. Understanding, developing and validating larger diameter HIAD designs will require an extensive ground testing campaign. The National Full-Scale Aerodynamics Complex (NFAC) at NASA Ames Research Center is a unique facility primarily used for determining aerodynamic characteristics of large-scale and full-scale rotorcraft and powered-lift V/STOL aircraft, as well as testing of wind turbines, parachutes, trucks, and other non-traditional types of testing. The facility is composed of two large test sections and a common, six-fan drive system. The 40-by-80 foot wind tunnel circuit is capable of providing test velocities up to 300 knots. This paper discusses the objectives, planning and challenges in testing large diameter (up to 8.5 m) HIADs in the NFAC 40 x 80 foot test section. An overview of the design reference mission, key driving requirements, structural analysis, instrumentation development and flexible aeroshell structural model validation approach will be presented. In addition, failure mode testing approaches will be presented to build further confidence in developing HIAD technology for infusion into near term flight demonstration missions.

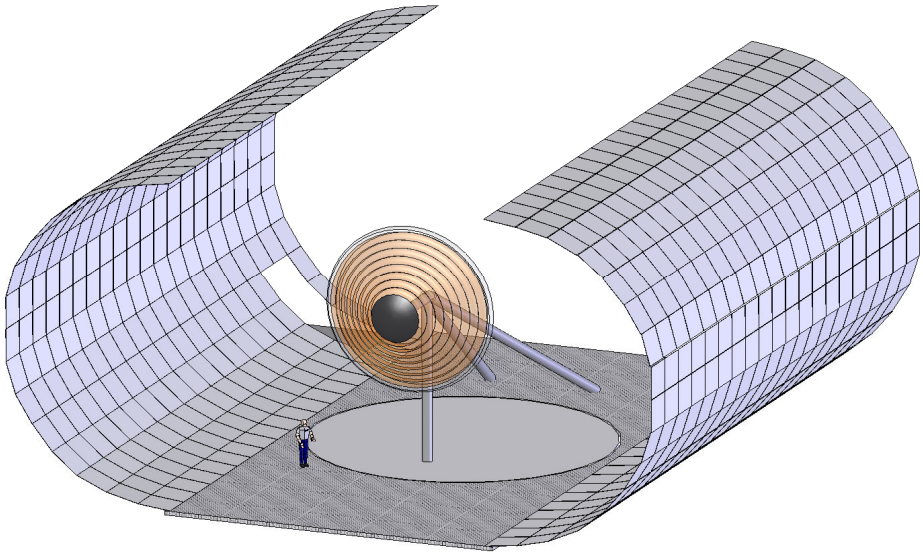

**Figure 1**- 6 meter diameter HIAD test article concept placed in the 40 x 80 foot test section of the NFAC.